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# BIOLOGICAL BULLETIN

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## ANOTHER MALE COPEPOD OF THE GENUS SALMINCOLA FROM THE GILLS OF THE CHINOOK SALMON.

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The only male copepod known to exist in the genus *Salmincola* of the family Lernæopodidæ is that of *Salmincola edwardsii* (Olsson) Wilson, which parasitizes the brook trout *Salvelinus fontinalis* Mitchill of many of the states of the middle West and East. This male has been described and figured by the writer in the BIOLOGICAL BULLETIN, Vol. XXVII., for August, 1914. During the latter part of the summer of 1919, the author obtained large numbers of another species of *Salmincola*, namely, *Salmincola beani* Wilson, parasitic on the gills of the chinook salmon *Oncorhynchus tshawytscha* Walbaum of Green River, Auburn Washington, and a careful search amongst these parasites, resulted in the discovery of three mature males.

The size of these new male *Salmincola* is much larger than that of *Salmincola edwardsii* (compare Figs. 1 and 3 with 4). The former (Figs. 1 and 3) measure about 1.0 mm. in length and about 0.17 mm. in width in the region of the reproductive organs; whereas the latter (Fig. 4) are about 0.7 mm. long and 0.1 mm. wide in the region of the gonads. Otherwise their structure seems to be similar.

The organs which are of particular interest and importance in the male are the reproductive organs. These are paired structures, located laterally in the posterior region of the body (Fig. 1, *r*), between the digestive tract and the body wall. They consist essentially of the following three main parts: (1) the testes (Fig. 2, *t*), (2) the coiled vas deferens (Fig. 2, *v*), and (3) the

pear-shaped spermatophores (Fig. 2, *s*). The spermatozoa are manufactured in the testes, from which they are conducted into the vas deferens, and from here they are then conveyed into the spermatophores, where they are stored until the male is ready to fertilize the female. Located near the spermatophores, on the ventral side of the body are two openings, the ejaculatory pores (Fig. 2, *e*), through which the spermatophores may be extruded.

Fertilization in the Lernæopodidæ occurs shortly after the attachment of the free-living copepods to the host. In *Salmincola edwardsii* it takes place about two and one half to three weeks after attachment, and in the species under consideration, *Salmincola beani*, although the time of fertilization has not been accurately determined, it, in all probability, takes place after a similar lapse of time. When the copepods are ready for fertilization, the male is about one third or one fourth the size of the female.

Prior to fertilization the males and females hang side by side on the gills of the host, being attached by the so-called attachment filaments. In the male, the attachment filament remains long and tubular, with an enlarged bulla-like structure at one end which is firmly fastened in the flesh of the gill, while the opposite end is slightly enlarged and to it are attached the terminal claws of the male's second maxillæ. In the case of the female, the tubular portion of the attachment filament disintegrates shortly after the attachment of the female to the host, so that only the bulla-like portion remains for the attachment of the parasite.

In order to effect fertilization the male must seek out a female, release his hold on the gill, and then in some way become attached to the posterior margin of the female's body, in the region of the genital pores. The specific manner in which this is accomplished is as follows: When the male reaches maturity he undergoes circling movements. If he meets a female in the radius of his explorations, he grasps her body with the terminal claws of his free maxillipeds and at the same time releases his hold on the attachment filament. The male now creeps over the body of the female until he reaches the neighborhood of her genital

pores and here he attaches himself and remains until after fertilization. In Fig. 1 the male is seen attached to the middle of the body of the female, while in Figs. 3 and 4 the male is at the posterior margin of the female, in the vicinity of the genital pores ready to fertilize her.

Fertilization is accomplished by the male bending the posterior portion of his body towards the genital pores of the female. Then the male extrudes his two spermatophores through the ejaculatory pores, and by means of the second maxillæ he attaches these near the genital openings of the female. The spermatozoa soon wander through these openings and become stored in the spermatheca of the female. After the migration of all the spermatozoa, the spermatophores shrivel up and come to look like transparent, shell-like, yellowish spheres. Very shortly after fertilization the male dies, while the female lives on and develops a great many young, which are capable of carrying on the life-history of the species. In order to insure fertilization, it is by no means uncommon to find that many of the females have been fertilized by more than a single male.

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## EXPLANATION OF PLATE I.

1. Male *Salmincola beani* Wilson, attached to middle of the abdomen of a mature female. The reproductive organs (*r*) can be distinctly seen.  $\times 65$ .
2. An enlarged photograph of the reproductive organs of the male seen in Fig. 1. *t*, testis; *v*, vasa deferens; *s*, spermatophore; *e*, ejaculatory pore.  $\times 183$ .
3. Male *Salmincola beani* Wilson in position near the genital pores of the female.  $\times 65$ .
4. Male *Salmincola edwardsii* (Olsson) Wilson attached to genital region of female.  $\times 65$ .

